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Hints for emplacement of a ring complex from AMS investigations: results of a reconnaissance study from the Åva granite (SW Finland)

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The ca. 1800 Ma old Åva granite in SW Finland was intruded at the end of the Svecofennian orogenesis as a ring dyke complex in about 1 to 5 km depth (Eklund & Shebanov 2005). It was emplaced into a 1830 – 1800 Ma old migmatic microcline granite of almost circular shape (Ehlers et al. 1993 and Ehlers pers. comm.) and its host rocks (Svecofennian amphibolites and migmatic mica schists and gneisses).

Investigations of the magnetic susceptibility (MS) and its anisotropy (AMS) were employed to three samples from the Åva granite (4 measuring cylinders per sample with a volume of 10 cm^3) and to one from the migmatic microcline granite (only one measuring cylinder due to sample size) to get first hints for the emplacement mode of both the plutons and their relation to each other.

The Åva granite is coarse grained with up to 4 cm big K-feldspar phenocrysts. The matrix consists of K-feldspar, plagioclase, quartz, biotite, sphene, apatite and titanomagnetite. Quartz shows chessboard patterns, indicating high temperature solid state deformation. Moreover, quartz and K-feldspar recrystallize in micro-shear zones and K-feldspar phenocrysts are mantled by dynamically recrystallizing small K-feldspar grains; myrmekite is also common. The migmatic microcline granite, on the other hand, consists of quartz (with deformation lamellae and chessboard patterns), perthitic microcline, plagioclase with deformation twinning, biotite and garnet.

The magnetic investigations show the Åva granite to be ferrimagnetic (MS in the range 10^{-3} to 10^{-2}) with titanomagnetite as the main MS carrier. Anisotropy of the AMS ellipsoids is generally quite high ranging from 15 to 40%. This high anisotropy is probably the result of both: emplacement-related deformation and interaction of individual titanomagnetite grains. The shape of the AMS ellipsoids of the Åva granite is generally prolate with a well defined steep magnetic lineation. Magnetic foliations follow the ring structure of the Åva granite complex. Anisotropy, shape and orientation of the AMS fabric are interpreted to be the result of fast upward flow within the individual ring dykes accompanied by shear deformation during emplacement. MS and AMS of the hosting migmatic microcline granite differ strongly from the magnetic characteristics of the Åva granite. The migmatic microcline granite is paramagnetic (MS in the range of 10^{-5} SI with biotite as MS carrier), the AMS ellipsoid is strongly oblate, its anisotropy is very low (3%), and the magnetic linetion lies flat in contrast to the steep magnetic lineation of the Åva granite. However, the magnetic foliation within the migmatic microcline granite follows the orientation of the ring dykes. The low anisotropy of the AMS ellipsoid allows the magnetic fabric of the migmatic microcline granite to be interpreted as a magmatic flow fabric. The oblate shape of the AMS ellipsoid might be the result of two factors: (1) the tabular shape of the MS carrier biotite and (2) flattening during emplacement of the migmatic granite itself and/or the ring dykes of the Åva granite.

References

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